General

Guideline Title

Aortic valve and ascending aorta guidelines for management and quality measures.

Bibliographic Source(s)

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Guideline Status

This is the current release of the guideline.

Recommendations

Major Recommendations

Definitions for the level of the evidence (A-C) and class of recommendations (I-III) are provided at the end of the "Major Recommendations" field.

Summary and Update of American College of Cardiology Foundation (ACCF)/American Heart Association (AHA) Guidelines for Indications and Timing of Surgery

Indications for Aortic Valve Surgery

Aortic Stenosis (AS)

Class I

1. Aortic valve replacement (AVR) is recommended in patients with severe AS at the onset of symptoms of dyspnea, angina, or lightheadedness or syncope (see Fig. 1 in the original guideline document) (Ross & Braunwald, 1968; Schwarz et al., 1982; Sprigings & Forfar, 1995; Horstkotte & Loogen, 1988; Iivanainen et al., 1996; Kelly et al., 1988; Pellikka et al., 2005; Frank, Johnson, & Ross, 1973; Bach et al., 2009). (Level of evidence B)
2. AVR is recommended, regardless of symptoms, with the identification of left ventricular (LV) systolic dysfunction (ejection fraction [EF] <50%). (Level of evidence C)
3. AVR is recommended in patients with severe AS who are scheduled to undergo coronary artery bypass graft surgery (CABG), surgery on other cardiac valves, or surgery on the aortic root or ascending aorta. (Level of evidence C)

Class IIa

1. AVR is reasonable in patients with moderate AS undergoing CABG or surgery on the aorta or other heart valves (Moreira et al., 2001; Filsoufi et al., 2002; Smith et al., 2004; Gillinov & Garcia, 2005). (Level of evidence B)

Class IIb

1. Exercise testing in asymptomatic patients with AS to determine the need for AVR may be considered to elicit exercise-induced symptoms and abnormal blood pressure responses (Alborino et al., 2002; Amato et al., 2001; Das, Rimington, & Chambers, 2005). (Level of evidence B)
2. AVR may be considered for asymptomatic patients with severe AS and abnormal response to exercise (e.g., asymptomatic hypotension). (Level of evidence C)
3. AVR may be considered for adults with severe asymptomatic AS if there is a high likelihood of rapid progression (age, calcification, and coronary artery disease [CAD]) or if surgery might be delayed at the time of symptom onset. (Level of evidence C)
4. AVR may be considered in patients undergoing CABG who have mild AS when there is evidence, such as moderate to severe valve calcification, that progression may be rapid. (Level of evidence C)
5. AVR may be considered for asymptomatic patients with extremely severe AS (aortic valve area [AVA] <0.6 cm^2, mean gradient >60 mm Hg, and jet velocity >5.0 m/s) when the patient's expected operative mortality is less than 1%. (Level of evidence C)

Class III

1. AVR is not useful for the prevention of sudden death in asymptomatic patients with AS who have normal LV systolic function (Otto et al., 1997). (Level of evidence B)

Aortic Regurgitation

Class I

1. AVR or repair is indicated for symptomatic patients with severe AR irrespective of LV systolic function (see Fig. 2 in the original guideline document) (Greves et al., 1981; Bonow et al., 1988; Bonow et al., 1985; Klodas et al., 1996; Klodas et al., 1997; Turina et al., 1998; Tornos et al., 2006). (Level of evidence B)
2. AVR or repair is recommended for asymptomatic patients with chronic severe AR and LV systolic dysfunction (EF ≤50%) at rest (Greves et al., 1981; Bonow et al., 1988; Bonow et al., 1985; Klodas et al., 1996; Klodas et al., 1997; Turina et al., 1998; Tornos et al., 2006; Carabello et al., 1987; Cormier et al., 1986; Cunha et al., 1980; Daniel et al., 1985; Forman, Firth, & Barnard, 1980; Henry et al., 1980; Michel et al., 1995; Sheiban et al., 1986; Stone et al., 1984; Taniguchi et al., 1987). (Level of evidence B)
3. AVR or repair is recommended in patients with chronic severe AR who are undergoing CABG or surgery on the aorta or other heart valves. (Level of evidence C)

Class IIa

1. AVR or repair is reasonable for asymptomatic patients with severe AR with normal LV systolic function (>50%) but with severe LV dilation (end-diastolic dimension >75 mm or end-systolic dimension >55 mm) (Bonow et al., 1988; Bonow et al., 1985; Tornos et al., 2006; Carabello et al., 1987; Cormier et al., 1986; Cunha et al., 1980; Daniel et al., 1985; Henry et al., 1980; Michel et al., 1995; Sheiban et al., 1986; Stone et al., 1984; Fioretti et al., 1983). (Level of evidence B)

Class IIb

1. AVR or repair may be considered in patients with moderate AR who are undergoing CABG or surgery on the aorta or other heart valves. (Level of evidence C)
2. AVR or repair may be considered for asymptomatic patients with severe AR and normal LV systolic function at rest (EF >50%) when the degree of LV dilation exceeds an end-diastolic dimension of 70 mm or end-systolic dimension of 50 mm, when there is evidence of progressive LV dilation, declining exercise tolerance, or abnormal hemodynamic responses to exercise. (Level of evidence C)

Class III

1. AVR is not indicated for asymptomatic patients with mild, moderate, or severe AR and normal LV systolic function at rest (EF >50%) when the degree of LV dilation is not moderate or severe (see Fig. 20 in the original guideline document) (Bonow et al., 1983; Bonow et al., 1991; Tornos et al., 1995; Ishii et al., 1996; Tarasoutchi et al., 2003). (Level of evidence B)

Aortic Valve Endocarditis

Class I

1. AVR is recommended in patients with aortic valve infective endocarditis and severe heart failure or cardiogenic shock due to aortic valve dysfunction when there is a reasonable likelihood of recovery with satisfactory quality of life after surgery (American College of Cardiology/American Heart Association Task Force on Practice Guidelines et al., 2006; Baddour et al., 2005; Richardson et al., 1978; Aranki et al., 1994; Hasbun et al., 2003). (Level of evidence B)
2. Surgery is recommended in patients with annular or aortic abscesses, heart block, infections resistant to antibiotic therapy, and fungal endocarditis (Baddour et al., 2005; Richardson et al., 1978; Aranki et al., 1994; Hasbun et al., 2003; Rubinstein & Lang, 1995). (Level of evidence B)

Class IIa

1. Surgery is reasonable in patients with infective endocarditis who present with recurrent emboli and persistent vegetations despite appropriate antibiotic therapy. (Level of evidence C)

Class IIb

1. Surgery to prevent embolization might be considered for patients with large vegetation size (>1.5 cm), especially if other relative indications for surgery are present (e.g., severe AR) and the surgical risk is low (Mugge et al., 1989; Thuny et al., 2005). (Level of evidence C)

Preoperative Testing and Assessment of Comorbid Disease and Frailty

Surgical Risk Scores

Class IIa

1. Performing risk score analysis is reasonable to evaluate patients undergoing surgical AVR or transcatheter aortic valve replacement (TAVR) to quantitate preoperative risk of mortality (PROM) (Leon et al., 2010; O'Brien et al., 2009; Dewey et al., 2006). (Level of evidence B)

Class IIb

1. Performing risk score analysis may be reasonable to aid in determining which patients should undergo AVR, TAVR or medical therapy alone in high-risk patients. (Level of evidence C)

Echocardiography

Class I (Bonow et al., 2008)

1. Transthoracic echocardiography (TTE) is recommended for the diagnosis and assessment of AS or aortic regurgitation (AR) severity. (Level of evidence B)
2. Echocardiography is recommended in patients with AS or AR for the assessment of LV wall thickness, size, and function. (Level of evidence B)
3. TTE is recommended for reevaluation of patients with known AS or AR and changing symptoms or signs. (Level of evidence B)
4. TTE is recommended for the assessment of changes in hemodynamic severity and LV function in patients with known AS or AR during pregnancy. (Level of evidence B)
5. TTE is recommended for reevaluation of asymptomatic patients: every 6 months for severe AS or AR, every 1 to 2 years for moderate AS or AR, and every 3 to 5 years for mild AS or AR. (Level of evidence B)
6. Intraoperative transesophageal echocardiography (TEE) is recommended to check repairs or replacements. (Level of evidence B)

Exercise Testing

Class IIb

1. Exercise testing in asymptomatic patients with AS or AR may be considered to elicit exercise-induced symptoms and abnormal blood pressure responses. (Level of evidence B)

Class III

1. Exercise testing should not be performed in symptomatic patients with AS or AR. (Level of evidence B)

Dobutamine Stress Echocardiography and Cardiac Catheterization for Low-Flow/Low-Gradient Aortic Stenosis

Class IIa

1. Dobutamine stress echocardiography is reasonable to evaluate patients with low-flow/low gradient AS and LV dysfunction for possible AVR or TAVR (Leon et al., 2010; Otto et al., 1992; Bache, Wang, & Jorgensen, 1971; Bermejo et al., 1996; deFilippi et al., 1995; Lin et al., 1998; Monin et al., 2001; Monin et al., 2003; Nishimura et al., 2002; Schwammenthal et al., 2001). (Level of evidence B)
2. Cardiac catheterization for hemodynamic measurements with infusion of dobutamine can be useful for evaluation of patients with low-flow/low-gradient AS and LV dysfunction. (Level of evidence C)

Cardiac Catheterization

Class I

1. Coronary angiography is recommended before AVR in patients with AS or AR at risk for coronary CAD. (Level of evidence B)
2. Patients aged more than 45 years undergoing a valve procedure should undergo coronary imaging. (Level of evidence C)
3. Cardiac catheterization for hemodynamic measurements is recommended for assessment of severity of AS or AR in symptomatic patients when noninvasive tests are inconclusive or when there is a discrepancy between noninvasive tests and clinical findings. (Level of evidence C)
4. Coronary imaging is recommended before AVR in patients with AS or AR for whom a pulmonary autograft (Ross procedure) or root procedure is

contemplated and if the origin of the coronary arteries were not identified by noninvasive technique. (Level of evidence C)

Class IIb

1. For patients aged less than 45 years, computed tomography (CT) coronary angiography may be considered. (Level of evidence C)

Class III

1. Cardiac catheterization for hemodynamic measurements is not recommended for the assessment of severity of AS before AVR when noninvasive tests are adequate and concordant with clinical findings. (Level of evidence C)
2. Cardiac catheterization for hemodynamic measurements is not recommended for the assessment of LV function and severity of AS or AR in asymptomatic patients. (Level of evidence C)

Cannulation Options for Aortic Valve and Root Surgery

Class I

1. For most patients requiring a simple aortic valve procedure without ascending aortic disease, the distal ascending aorta is recommended as the site for cannulation (Svensson, Blackstone, & Cosgrov, 2003). (Level of evidence B)
2. For complex repairs involving the arch or a calcified aorta or porcelain aorta, use of the axillary artery with a side graft is recommended (Svensson, Blackstone, & Cosgrov, 2003). (Level of evidence B)

Mechanical Aortic Valves

Class I

1. Before mechanical AVR, all patients who have known CAD, have had a prior myocardial infarction, have angina pectoris as a symptom, or are greater than age 45, should have preoperative screening of their coronary arteries. (Level of evidence C)
2. All patients undergoing mechanical AVR should receive perioperative prophylactic antibiotics to cover both gram positive and negative organisms. (Level of evidence C)
3. All patients receiving a mechanical aortic valve should receive postoperative anticoagulation, beginning after valve implantation. (Level of evidence C)
4. All patients with mechanical aortic valve prostheses should receive prophylactic antibiotics for all dental or surgical procedures to prevent prosthetic endocarditis. (Level of evidence C)

Class IIa

1. Nasal mupirocin is probably indicated for methicillin resistant organism or routinely before and after operations. (Level of evidence C)
2. Preoperative chlorhexidine showers and mouth washes should be considered. (Level of evidence C)

Biological Valves

Class I

1. A bioprosthesis is recommended for AVR in patients of any age who will not take anticoagulation, either warfarin or the direct factor Xa or thrombin inhibitors or who have major medical contraindications to anticoagulation (American College of Cardiology/American Heart Association Task Force on Practice Guidelines et al., 2006). (Level of evidence C)
2. A bioprosthesis is recommended for AVR in patients aged 65 years or more without risk factors for thromboembolism (American College of Cardiology/American Heart Association Task Force on Practice Guidelines et al., 2006). (Level of evidence C)

Class IIa

1. Patient preference is a reasonable consideration in the selection of aortic valve prosthesis if appropriate surgical counseling is carried out.

Class IIb

1. A bioprosthesis may be considered for AVR in a woman of childbearing age who desires to have children (American College of Cardiology/American Heart Association Task Force on Practice Guidelines et al., 2006). (Level of evidence C)
2. A bioprosthesis may be reasonable for AVR in patients aged less than 65 years who elect to receive this valve for lifestyle considerations after detailed discussions of the risks of anticoagulation versus the likelihood that AVR may be necessary in the future (American College of Cardiology/American Heart Association Task Force on Practice Guidelines et al., 2006). (Level of evidence C)

Enlargement of the Aortic Annulus

Class I

1. Patch enlargement of the aortic annulus should be considered when the aortic annulus does not allow implantation of a heart valve with effective orifice

area (EOA) index more than 0.65 cm^2/m^2 (Blais et al., 2003; Pibarot & Dumesnil, 2000; Rao et al., 2000). (Level of evidence B)

Class IIb

1. Patch enlargement of the aortic annulus may be considered when the aortic annulus does not allow implantation of the heart valve with EOA index of 0.85 cm^2/m^2. (Level of evidence C)

Homograft (Allograft) Replacement of the Aortic Valve

Class I

1. Homograft replacement of the aortic root should be considered for patients with extensive active endocarditic destruction of the aortic annulus (Grinda et al., 2005; Klieverik et al., 2009; Lytle et al., 2002; Musci et al., 2010; Yankah et al., 2005). (Level of evidence B)
2. For patients undergoing homograft replacement of the aortic valve, a total root replacement technique is recommended (Athanasiou et al., 2006; Takkenberg et al., 2002). (Level of evidence B)

Class IIa

1. Homograft replacement of the aortic valve can be considered for patients with endocarditis without annular destruction, especially when the potential for reinfections elevated (Svensson, Blackstone, & Cosgrove, 2003; Lund et al., 1999; Takkenberg et al., 2007). (Level of evidence B)
2. Homograft replacement of the aortic valve can be considered for patients undergoing reoperative aortic root surgery in whom anatomic or physiologic constraints mitigate against more conventional composite graft replacement or for whom life expectancy is less than the projected durability of the homograft (Avierinos et al., 2007; Hagl et al., 2002; Moon et al., 2001). (Level of evidence B)

Class III

1. Homografts are not recommended for routine AVR. Currently available xenografts have excellent hemodynamics, durability comparable to homografts and are simpler to replace (El-Hamamsy et al., 2010; O'Brien et al., 2001; Smedira et al., 2006). (Level of evidence B)

Stentless Aortic Valves

Subcoronary Stentless Valve Implantation for Aortic Valve Replacement

Class I

1. Before subcoronary stentless AVR, all patients who have known CAD, have had a prior myocardial infarction, have angina pectoris as a symptom, or are more than 45 years of age, should have preoperative screening of their coronary arteries, by direct coronary angiography. (Level of evidence C)
2. Intraoperative TEE is recommended to check the valve function. (Level of evidence C)
3. Prophylactic antibiotics for any invasive procedure, including dentistry, are recommended. (Level of evidence C)

Class IIb

1. Stentless valves may be a reasonable prosthesis choice in patients aged more than 70 years with nonregurgitant, trileaflet AS who desire a tissue prosthesis and are at risk for patient-prosthetic mismatch (PPM). (Level of evidence C)

Full Aortic Root Replacement with a Stentless Prosthesis

Class I

1. Before aortic root replacement, all patients who have known CAD, have had a prior myocardial infarction, have angina pectoris as a symptom, or are aged more than 45 years, should have preoperative screening of their coronary arteries by direct coronary angiography. (Level of evidence C)
2. Intraoperative TEE is required to check the valve function. (Level of evidence C)
3. Prophylactic antibiotics for any invasive procedure including dentistry are recommended. (Level of evidence C)

Class IIa

1. Stentless aortic valve full root replacement may be considered in patients aged more than 70 years with aortic root dilation. (Level of evidence C)

Class IIb

1. Stentless aortic valve full root replacement may be considered in patients aged more than 70 years at high risk for PPM who desire a tissue prosthesis. (Level of evidence B)

Pulmonary Autograft (Ross Procedure)

Class I

1. The Ross procedure is recommended in infants and small children for whom no satisfactory alternative valve substitute exists. (Level of evidence C)

Class IIb

1. The Ross procedure may be considered in older children and young adults because of low operative risk, but patients and their families must be informed of the possible need for reoperation which increases over time. (Level of evidence C)

Class III

1. The Ross procedure is not recommended for middle-aged or older adults when suitable alternatives to autograft replacement of the aortic valve are available with comparable results and without the need for replacement of the right ventricular outflow tract (RVOT), as the latter adds the additional risk of pulmonary valve dysfunction and subsequent replacement. (Level of evidence C)
2. The Ross procedure is not recommended for patients with bicuspid valves and AR or aortic dilation if other alternatives are available. (Level of evidence C)

Balloon Aortic Valvuloplasty (BAV)

Class IIa

1. BAV can be useful as bridge to AVR in hemodynamically unstable adult patients with severe AS where immediate AVR is not feasible. (Level of evidence C)
2. BAV should be considered for patients with contraindications to AVR who can potentially be bridged to AVR or TAVR in future. (Level of evidence C)
3. BAV should be considered in severely symptomatic patients with multiple comorbidities where contribution of AS to symptomatology such as chronic pulmonary disease or poor LV function, remains unclear. (Level of evidence C)

Class IIb

1. BAV may be reasonable in severely symptomatic patients where AVR is not an option for symptom relief. (Level of evidence C)
2. BAV may be considered in patients with symptomatic severe AS who require urgent major noncardiac surgery. (Level of evidence C)
3. BAV may be considered as a palliative measure in individual cases when surgery is contraindicated because of severe comorbidities. (Level of evidence C)
4. Hemodynamic assessment including cardiac output, aortic, LV and pulmonary pressures may be considered before, during and after the procedure. (Level of evidence C)
5. Rapid ventricular pacing may be performed to stabilize balloon during inflation unless self seating dumbbell shaped or other specifically designed balloons are available that do not require pacing. (Level of evidence C)

Transcatheter Aortic Valve Replacement (TAVR)

TAVR with the Balloon-Expandable Valve

Note: The self-expanding nitinol bioprosthesis is currently available in Europe and is under investigation in the US Pivotal trials, but US recommendations are not available.

Class I

1. Evaluation for TAVR should be performed by a multidisciplinary team and panel (Leon et al., 2010; Smith et al., 2011). (Level of evidence A)
2. TAVR should be performed by a multidisciplinary cardiovascular and cardiac surgery team (Leon et al., 2010; Smith et al., 2011). (Level of evidence A)
3. If available as part of a research protocol or after U.S. Food and Drug Administration (FDA) approval, transfemoral AVR is recommended in inoperable patients provided they have an expected survival of greater than 1 year (Leon et al., 2010). (Level of evidence A)
4. If available as part of a research protocol or after FDA approval, transfemoral, transaortic, transaxillary, or transapical AVR with the balloon expandable valve can be considered in patients who are operative candidates and have a predicted surgical mortality greater than 15% and a Society of Thoracic Surgeons (STS) score greater than 10% by two independent surgical assessments (Smith et al., 2011). (Level of evidence A)
5. TAVR should be performed in a hybrid operating or catheterization room dedicated to the procedure and not with mobile c-arms (Leon et al., 2010; Smith et al., 2011). (Level of evidence B)

Class III

1. Transfemoral aortic valve implantation with a balloon-expandable valve should not be performed in patients who are not at high risk for conventional surgery. (Level of evidence C)
2. Transfemoral aortic valve implantation with a balloon-expandable valve should not be performed in patients who have other comorbidities that limit 1-year survival or whose extreme frailty limits the likelihood of functional recovery after TAVR. (Level of evidence C)

Transapical Aortic Valve

Class I

1. Transapical insertion of a balloon expandable aortic valve is recommended in patients with symptomatic severe AS who are considered to be at excessive risk for conventional AVR and are not candidates for a transfemoral approach due to preexisting peripheral vascular disease, and who have an expected survival of at least 1 year (Smith et al., 2011). (Level of evidence B)
2. Evaluation for TAVR should be performed by a multidisciplinary team and panel (Leon et al., 2010; Smith et al., 2011). (Level of evidence A)
3. TAVR should be performed by a multidisciplinary cardiovascular and cardiac surgery team with extensive experience with high-risk valve surgery and percutaneous coronary interventions and balloon valvuloplasty (Leon et al., 2010; Smith et al., 2011). (Level of evidence A)
4. If available as part of a research protocol or after FDA approval, transfemoral, transaortic, transaxillary, or transapical AVR with the balloon expandable valve can be considered in patients who are operative candidates and have a predicted surgical mortality greater than 15% and an STS score greater than 10% by two independent surgical assessments (Smith et al., 2011). (Level of evidence A)
5. TAVR should be performed in a hybrid operating or catheterization room dedicated to the procedure and not with mobile c-arms (Leon et al., 2010; Smith et al., 2011). (Level of evidence B)

Class IIa

1. Transapical insertion of a balloon expandable aortic valve may be a reasonable alternative in patients with critical AS who have an estimated mortality of at least 15% as independently judged by two cardiothoracic surgeons, or who have a predicted risk of mortality using the STS-PROM algorithm of 10% or greater, and do not have access for the transfemoral approach. The PARTNER A trial was not powered to access noninferiority. (Level of evidence C)

Class III

1. Transapical insertion of a balloon expandable aortic valve is not recommended for low-risk patients with critical AS who are considered good candidates for conventional valve replacement. (Level of evidence C)

Transaortic Valve Replacement

Class I

1. Evaluation for TAVR should be performed by a multidisciplinary team and panel (Leon et al., 2010; Smith et al., 2011). (Level of evidence A)
2. TAVR should be performed by a multidisciplinary cardiovascular and cardiac surgery team (Leon et al., 2010; Smith et al., 2011). (Level of evidence A)
3. If available as part of a research protocol or after FDA approval, transfemoral, transaortic, transaxillary, or transapical AVR with the balloon expandable valve can be considered in patients who are operative candidates and have a predicted surgical mortality greater than 15% and an STS score greater than 10% by two independent surgical assessments (Smith et al., 2011). (Level of evidence A)
4. TAVR should be performed in a hybrid operating or catheterization room dedicated to the procedure and not with mobile c-arms (Leon et al., 2010; Smith et al., 2011). (Level of evidence B)

Class IIa

1. Direct aortic insertion of a self-expanding or balloon expandable aortic valve may be a reasonable alternative in patients with critical aortic stenosis who are contraindicated for conventional aortic valve replacement and are not candidates for a transfemoral approach due to preexisting peripheral vasculature disease, and who have an expected survival of at least 1 year. (Level of evidence B)
2. Direct aortic insertion of a self-expanding or balloon expandable aortic valve may be a reasonable alternative in patients with critical aortic stenosis who have an estimated mortality of at least 15% as independently judged by two cardiothoracic surgeons or who have a predicted risk of mortality using the STS-PROM algorithm of 10% or greater and do not have access for the transfemoral approach. (Level of evidence C)

Class III

1. Direct aortic insertion of a self-expanding or balloon expandable aortic valve is not recommended in low risk patients with critical aortic stenosis who are considered good candidates for conventional valve replacement. (Level of evidence C)

Transaxillary or Subclavian Valve Approach

Class I

1. Evaluation for TAVR should be performed by a multidisciplinary team and panel (Leon et al., 2010; Smith et al., 2011). (Level of evidence A)
2. TAVR should be performed by a multidisciplinary cardiovascular and cardiac surgery team (Leon et al., 2010; Smith et al., 2011). (Level of evidence A)
3. If available as part of a research protocol or after FDA approval, transfemoral, transaortic, transaxillary, or transapical AVR with the balloon expandable valve can be considered for patients who are operative candidates and have a predicted surgical mortality greater than 15% and an STS score greater than 10% by two independent surgical assessments (Smith et al., 2011). (Level of evidence A)
4. TAVR should be performed in a hybrid operating or catheterization room dedicated to the procedure and not with mobile c-arms (Leon et al., 2010; Smith et al., 2011). (Level of evidence B)

Class IIa

1. Transaxillary or subclavian insertion of a self-expanding or balloon expandable aortic valve may be a reasonable alternative in patients with critical aortic stenosis who are contraindicated for conventional aortic valve replacement and are not candidates for a transfemoral approach because of preexisting peripheral vasculature disease, and who have an expected survival of at least 1 year. (Level of evidence B)
2. Transaxillary or subclavian insertion of a self-expanding or balloon expandable aortic valve may be a reasonable alternative in patients with critical aortic stenosis who have an estimated mortality of at least 15% as independently judged by two cardiothoracic surgeons, or who have a predicted risk of mortality using the STS-PROM algorithm of 10% or greater and do not have access for the transfemoral approach. (Level of evidence C)

Class III

1. Transaxillary or subclavian insertion of a self-expanding or balloon expandable aortic valve is not recommended for low-risk patients with critical aortic stenosis who are considered good candidates for conventional valve replacement. (Level of evidence C)

Aortic Valve Leaflet Remodeling, Reimplantation, and Repair

Remodeling

Class I

1. Aortic valve repairs should be checked by intraoperative TEE after the repairs is completed. (Level of evidence C)
2. Patients should be followed postoperatively by yearly echocardiograms after aortic valve repair. (Level of evidence C)

Class IIa

1. Root remodeling may be considered for patients with significantly dilated roots and bicuspid valves or patients with acute aortic dissection, including excision of the non-coronary sinus as a remodeling procedure, also known as the Wolfe procedure. (Level of evidence C)

Class III

1. Root remodeling should be avoided in patients with connective tissue disorders. (Level of evidence C)

Reimplantation

Class I

1. Root size, particularly at the sinuses of Valsalva should be measured by CT or magnetic resonance imaging (MRI) using the external diameter at its greatest extent. Conventionally TEE is used to measure the internal diameter at its greatest extent, usually from sinus to sinus (Hiratzka et al., 2010). (Level of evidence B)
2. Intraoperative TEE is recommended to check the repair. (Level of evidence C)
3. Reimplantation is recommended for young patients, when feasible, who have aortic root dilation, with or without regurgitation, and a tricuspid aortic valve. (Level of evidence C)
4. An aortic root greater than 5.0 cm is recommended as a threshold for prophylactic repair for most patients, including patients with Marfan syndrome. (Level of evidence C)
5. In patient with a family history of aortic dissection and Marfan syndrome, surgery is recommended at a size of 4.5 cm in cross-sectional diameter. (Level of evidence C)
6. Gram-positive and gram-negative prophylactic antibiotics should be administered at the time of surgery. (Level of evidence C)
7. The patient should have yearly echocardiograms. (Level of evidence C)
8. Prophylactic antibiotics for any invasive procedure including dentistry are recommended. (Level of evidence C)

Class IIa

1. For patients with Loeys-Dietz syndrome, a threshold of 4.2 cm maybe considered for surgery. (Level of evidence C)
2. The cross-sectional area of the root in square centimeters divided by the patient's height in meters and exceeding 10 may be considered an indication for surgery. (Level of evidence C)
3. In female patients with a connective tissue disorder who are considering pregnancy, a prophylactic repair may be considered when the aortic root exceeds 4.0 cm. (Level of evidence C)
4. An antiplatelet agent should be considered postoperatively. (Level of evidence C)

Bicuspid Valve Repair with or without Aortic Tube Graft Replacement

Class I

1. All patients undergoing bicuspid repair should undergo intraoperative TEE. (Level of evidence C)
2. Prophylactic antibiotics including both gram-positive and gram-negative coverage should be used for patients undergoing bicuspid valve repair. (Level of evidence C)
3. Postoperative beta-blockers should be considered after bicuspid valve repairs. (Level of evidence C)

4. Angiotensin-converting enzyme (ACE) inhibitor therapy should be considered in patients with low EF postoperatively. (Level of evidence C)
5. Patients should be given prophylactic antibiotics at any time that an invasive procedure is done, including dental procedures, after a bicuspid valve repair. (Level of evidence C)

Management of Acute Aortic Root and Ascending Aortic Dissection

Class I

1. Timely diagnosis is recommended utilizing cross-sectional imaging techniques or TEE. The latter can be performed in the operating room before sternotomy if needed to confirm the diagnosis (Hiratzka et al., 2010). (Level of evidence B)
2. Ascending aortic replacement (including resection of primary aortic tear) should be performed for patients with acute type A aortic dissection (Hiratzka et al., 2010). (Level of evidence B)
3. An open distal anastomotic, hemiarch or total arch replacement technique is effective for the distal reconstruction of an acute type A dissection (Hiratzka et al., 2010). (Level of evidence B)
4. Ascending aortic and aortic arch replacement is indicated for patients with acute type A aortic dissection and a primary or secondary tear within the arch that involves or extends beyond the left common carotid arterial ostium with marked dilation of the aortic arch (>50 mm). (Level of evidence C)
5. Aortic root replacement is indicated for patients with acute type A aortic dissection and a primary tear that extends or originates in the left or right coronary sinuses or marked dilation (>45 mm) of the aortic root below the sinotubular junction. (Level of evidence C)
6. Arterial inflow cannulation for cardiopulmonary bypass during type A dissection repair should perfuse the true lumen directly. (Level of evidence C)
7. Long-term radiologic surveillance after aortic dissection with or without surgical reconstruction should be performed at regular intervals of at least every 6 months for the first year and then annually. (Level of evidence C)
8. Long-term annual echocardiographic surveillance is recommended for patients in whom an aortic valve preserving reconstruction or bioprosthetic valve replacement was performed. (Level of evidence C)

Class IIa

1. It is reasonable to use antegrade brain perfusion (ABP) or retrograde brain perfusion (RBP) with hypothermic circulatory arrest (HCA) to complete aortic arch reconstructions to reduce neurologic complications (Hiratzka et al., 2010). (Level of evidence B)
2. It is reasonable to utilize either an aortic valve-sparing or valve-replacement strategy when managing acute type A dissection if an acceptably low mortality rate can be achieved (Hiratzka et al., 2010). (Level of evidence B)
3. It is reasonable to treat acute type A intramural hematomas (IMH) with urgent surgical intervention (Hiratzka et al., 2010). (Level of evidence B)
4. Use of intraoperative TEE is encouraged (Hiratzka et al., 2010). (Level of evidence B)
5. Postoperative, lifelong cross-sectional radiologic surveillance is reasonable in patients with residual aortic dissecting beyond the replaced aortic segment. (Level of evidence C)

Class IIb

1. Medical management and longitudinal surveillance may be considered to treat high-risk patients with asymptomatic, radiologically stable type A IMH. (Level of evidence C)
2. Medical management and longitudinal surveillance may be considered in patients with type B dissections involving the aortic arch. (Level of evidence C)
3. Annual echocardiography may be considered in type A aortic dissection patients in whom the aortic valve was resuspended, preserved or replaced with a bioprosthesis. (Level of evidence C)

Ascending Aorta and Aortic Arch

Class I

1. All patients with suspected thoracic aortic disease on the basis of family history, symptoms, or physical examination should have the entire thoracic aorta imaged. (Level of evidence C)
2. All patients with a bicuspid aortic valve should undergo imaging of the thoracic aorta (Hiratzka et al., 2010). (Level of evidence B)
3. All patients with Marfan syndrome or Loeys-Dietz syndrome or mutations associated with aortic disease or dissection should have the entire aorta imaged and appropriate blood testing performed for genetic mutations (Hiratzka et al., 2010). (Level of evidence B)
4. First-degree relatives of young patients with a bicuspid aortic valve or genetic mutation associated aortic disease of the thoracic aortic disease should be advised to be further investigated. (Level of evidence C)
5. All patients for whom planned elective valvular surgery is planned and who have associated thoracic aortic disease should undergo preoperative cardiac catheterization (Hiratzka et al., 2010). (Level of evidence B)
6. Additional testing to quantitate a patient's comorbid status and develop a risk profile is recommended. These tests may include for particularly high-risk patients CT of the chest if not already done, pulmonary function tests (PFTs), 24-hour Holter monitoring, noninvasive carotid screening, brain imaging, echocardiography, neurocognitive testing, and assessment of degree of frailty. (Level of evidence C)
7. Intraoperative TEE is recommended for all patients undergoing surgery for thoracic aortic disease. (Level of evidence C)
8. Surgical repair is recommended when the ascending aorta or aortic root exceeds 5.5 cm if the patient has no genetically based aortic disease and is otherwise a suitable candidate for surgery (Hiratzka et al., 2010). (Level of evidence B)

9. Patients with genetically associated aortic diseases, including those with a bicuspid aortic valve, should undergo surgery at diameters exceeding 5.0 cm unless a family history of aortic dissection is present, then it is acceptable to lower the threshold to 4.5 cm. Alternatively, patients with a maximal ascending aortic area (pi r^2, cm^2) to height in meters ratio exceeding 10 should be considered for surgery (Hiratzka et al., 2010). (Level of evidence B)
10. Patients with a growth rate exceeding 0.5 cm per year should be recommended to undergo surgery if no other limitations apply (Hiratzka et al., 2010). (Level of evidence B)
11. For patients with Loeys-Dietz syndrome or confirmed TGFBR1 or TGFBR2 mutation should be evaluated for repair of the aorta when the diameter exceeds 4.2 cm. (Level of evidence C)
12. For patients undergoing cardiac surgery other than for aortic indications, aortic repair is recommended when diameter exceeds 4.5 cm (Hiratzka et al., 2010). (Level of evidence B)
13. Aortic diameters should be measured at right angles to the axis of flow, which requires the use of three dimensional reconstructive software. The maximal diameters at each segment of the aorta should be reported. Echocardiography measures internal diameters while CT and MRI measures external diameters, and thus some allowance should be made for echocardiographic measurements being smaller. (Level of evidence C)
14. Separate valve and ascending aortic replacement are recommended for patients without significant aortic root dilation, for elderly patients, and for young patients with minimal dilation in whom a biological valve is being inserted or a bicuspid valve is being repaired (Hiratzka et al., 2010). (Level of evidence B)
15. Patients with Marfan, Loeys-Dietz, and Ehlers-Danlos syndromes and root dilation should undergo excision of the sinuses in combination with a modified David valve reimplantation procedure if technically feasible or insertion of a valve graft conduit (Hiratzka et al., 2010). (Level of evidence B)
16. For more complicated arch reconstructions requiring extended periods of circulatory arrest, use of adjunctive brain perfusion techniques is recommended (Hiratzka et al., 2010). (Level of evidence B)

Class IIa

1. Regular echocardiography and MRI or CT evaluation after repair of thoracic aortic disease is reasonable. (Level of evidence C)

Definitions:

American College of Cardiology Foundation/American Heart Association (ACCF/AHA) Classification of Recommendations and Level of Evidence

<table>
<tr><td colspan="2"></td><td colspan="5">Size of Treatment Effect</td></tr>
<tr><td colspan="2" rowspan="2"></td><td rowspan="2">CLASS I

Benefit >>> Risk

Procedure/Treatment SHOULD be performed/ administered</td><td rowspan="2">CLASS IIa

Benefit >> Risk Additional studies with focused objectives needed

IT IS REASONABLE to perform procedure/administer treatment</td><td rowspan="2">CLASS IIb

Benefit ≥ Risk Additional studies with broad objectives needed; additional registry data would be helpful

Procedure/Treatment MAY BE CONSIDERED</td><td colspan="3">CLASS III No Benefit
or Class III Harm</td></tr>
<tr><td></td><td>Procedure/Test</td><td>Treatment</td></tr>
<tr><td colspan="2" rowspan="2"></td><td rowspan="2"></td><td rowspan="2"></td><td rowspan="2"></td><td>COR III: No Benefit</td><td>Not helpful</td><td>No proven benefit</td></tr>
<tr><td>COR III: Harm</td><td>Excess cost without benefit or harmful</td><td>Harmful to patients</td></tr>
<tr><td rowspan="2">Estimate of Certainty (Precision) of Treatment Effect</td><td>LEVEL A

Multiple populations evaluated*

Data derived from multiple randomized clinical trials or meta-analyses</td><td>Recommendation that procedure or treatment is useful/effective
Sufficient evidence from multiple randomized trials or meta-analyses</td><td>Recommendation in favor of treatment or procedure being useful/effective
Some conflicting evidence from multiple randomized trials or meta-analyses</td><td>Recommendation's usefulness/efficacy less well established
Greater conflicting evidence from multiple randomized trials or meta-analyses</td><td colspan="3">Recommendation that procedure or treatment is not useful/effective and may be harmful
Sufficient evidence from multiple randomized trials or meta-analyses</td></tr>
<tr><td>LEVEL B

Limited populations</td><td>Recommendation that procedure or treatment is useful/effective</td><td>Recommendation in favor of treatment or procedure being</td><td>Recommendation's usefulness/efficacy less well established</td><td colspan="3">Recommendation that procedure or treatment is not useful/effective and may be harmful</td></tr>
</table>

		Size of Treatment Effect			
	evaluated*	• Evidence from	useful/effective	• Greater conflicting evidence from single randomized trial or nonrandomized studies	• Evidence from single randomized trial or nonrandomized studies
	Data derived from a single randomized clinical trials or nonrandomized studies	single randomized trial or nonrandomized studies	• Some conflicting evidence from single randomized trial or nonrandomized studies		
	LEVEL C Very limited populations evaluated* Only consensus opinion of experts, case studies or standard of care	• Recommendation that procedure or treatment is useful/effective • Only expert opinion, case studies, or standard of care	• Recommendation in favor of treatment or procedure being useful/effective • Only diverging expert opinion, case studies, or standard of care	• Recommendation's usefulness/efficacy less well established • Only diverging expert opinion, case studies, or standard of care	• Recommendation that procedure or treatment is not useful/effective and may be harmful • Only expert opinion, case studies, or standard of care

*Data available from clinical trials or registries about the usefulness/efficacy in different subpopulations, such as gender, age, history of diabetes, history of prior myocardial infarction, history of heart failure, and prior aspirin use. A recommendation with Level of Evidence B or C does not imply that the recommendation is weak. Many important clinical questions addressed in the guidelines do not lend themselves to clinical trials. Although randomized trials are unavailable, there may be a very clear clinical consensus that a particular test or therapy is useful or effective.

Clinical Algorithm(s)

The following algorithms are provided in the original guideline document:

- Management strategy for severe aortic stenosis
- Management strategy with chronic severe aortic regurgitation
- Surgical evaluation of patients for aortic valve replacement (AVR) or transcatheter aortic valve replacement (TAVR)

Scope

Disease/Condition(s)

Aortic valve and ascending aorta disease including:

- Aortic stenosis
- Aortic regurgitation
- Aortic valve endocarditis

Guideline Category

Evaluation

Management

Risk Assessment

Treatment

Clinical Specialty

Cardiology

Family Practice

Geriatrics

Internal Medicine

Radiology

Thoracic Surgery

Intended Users

Advanced Practice Nurses

Health Care Providers

Physician Assistants

Physicians

Guideline Objective(s)

- To outline pros and cons of treatment options
- To outline areas where further research is needed, potentially from updated Society of Thoracic Surgeons (STS) data collection variables as there are few randomized trials that give more absolute answers to questions
- To provide technical guidelines for aortic valve and aortic surgery
- To provide background for recommended quality measures and suggest quality measures
- To present the new STS valve data collection variables that address issues related to the preoperative testing and technical aspects of aortic valve surgery

Target Population

Adults with aortic valve or ascending aorta disease, including aortic stenosis, aortic regurgitation, or aortic valve endocarditis

Interventions and Practices Considered

1. Evaluating patients for aortic valve replacement (AVR) or repair
    - Evaluation of symptoms
    - Assessment of left ventricular (LV) systolic dysfunction
    - Exercise testing
    - Prognostic assessment
2. Preoperative testing and assessment of comorbid disease and frailty
    - Risk score analysis
    - Transthoracic echocardiography (TTE)
    - Intraoperative transesophageal echocardiography (TEE)
    - Exercise testing
    - Dobutamine stress echocardiography
    - Cardiac catheterization
    - Coronary angiography
3. Cannulation options for aortic valve and root surgery
4. Mechanical aortic valve placement
    - Preoperative screening of coronary arteries
    - Perioperative prophylactic antibiotics
    - Postoperative anticoagulation
    - Prophylactic antibiotics for all dental or surgical procedures to prevent prosthetic endocarditis
    - Nasal mupirocin

    - Preoperative chlorhexidine showers and mouthwash
5. Considerations for biological aortic valve prosthesis
6. Patch enlargement of the aortic annulus
7. Homograft replacement of the aortic valve
8. Subcoronary stentless valve implantation for aortic valve replacement
9. Full aortic root replacement with a stentless prosthesis
10. Pulmonary autograft (Ross procedure)
11. Balloon aortic valvuloplasty (BAV)
12. Transcatheter aortic valve replacement with the balloon-expandable valve
13. Transapical insertion of a balloon expandable aortic valve
14. Transaortic valve replacement
15. Transaxillary or subclavian valve approach
16. Aortic valve leaflet remodeling, reimplantation, and repair
17. Management of acute aortic root and ascending aortic dissection
18. Considerations for repair of the ascending aorta and/or the arch

Major Outcomes Considered

- Safety and effectiveness of repair, replacement, and other treatment
- Device success
- Procedural complications (e.g., stroke, hemorrhage, vascular complications)
- Survival
- Morbidity and mortality
- Readmission
- Hospital length of stay
- Costs
- Quality of life

Methodology

Methods Used to Collect/Select the Evidence

Hand-searches of Published Literature (Primary Sources)

Hand-searches of Published Literature (Secondary Sources)

Searches of Electronic Databases

Description of Methods Used to Collect/Select the Evidence

For this systematic review on the Aortic Valve and Ascending Aorta, specific search terms were identified and targeted searches were run in PubMed/MEDLINE in December 2011. The inclusion criteria for the literature search were limited to English language publications, and adult human subjects. The task force augmented the computerized literature search by manually reviewing the reference lists of identified studies and relevant reviews known to the expert committee. In addition, the writing group identified articles from personal files and undertook their own searches for assigned topics. The terms used included aorta, aortic valve, aortic stenosis, aortic regurgitation, bicuspid aortic valve, transcatheter valve, and guidelines.

Number of Source Documents

Not stated

Methods Used to Assess the Quality and Strength of the Evidence

Weighting According to a Rating Scheme (Scheme Given)

Rating Scheme for the Strength of the Evidence

American College of Cardiology Foundation/American Heart Association (ACCF/AHA) Classification of Recommendations and Level of Evidence

		Size of Treatment Effect					
		CLASS I *Benefit >>> Risk* Procedure/Treatment SHOULD be performed/ administered	CLASS IIa *Benefit >> Risk Additional studies with focused objectives needed* IT IS REASONABLE to perform procedure/administer treatment	CLASS IIb *Benefit ≥ Risk Additional studies with broad objectives needed; additional registry data would be helpful* Procedure/Treatment MAY BE CONSIDERED	CLASS III *No Benefit* or Class III *Harm*		
						Procedure/Test	Treatment
					COR III: No Benefit	Not helpful	No proven benefit
					COR III: Harm	Excess cost without benefit or harmful	Harmful to patients
Estimate of Certainty (Precision) of Treatment Effect	LEVEL A Multiple populations evaluated* Data derived from multiple randomized clinical trials or meta-analyses	• Recommendation that procedure or treatment is useful/effective • Sufficient evidence from multiple randomized trials or meta-analyses	• Recommendation in favor of treatment or procedure being useful/effective • Some conflicting evidence from multiple randomized trials or meta-analyses	• Recommendation's usefulness/efficacy less well established • Greater conflicting evidence from multiple randomized trials or meta-analyses	• Recommendation that procedure or treatment is not useful/effective and may be harmful • Sufficient evidence from multiple randomized trials or meta-analyses		
	LEVEL B Limited populations evaluated* Data derived from a single randomized clinical trials or nonrandomized studies	• Recommendation that procedure or treatment is useful/effective • Evidence from single randomized trial or nonrandomized studies	• Recommendation in favor of treatment or procedure being useful/effective • Some conflicting evidence from single randomized trial or nonrandomized studies	• Recommendation's usefulness/efficacy less well established • Greater conflicting evidence from single randomized trial or nonrandomized studies	• Recommendation that procedure or treatment is not useful/effective and may be harmful • Evidence from single randomized trial or nonrandomized studies		
	LEVEL C Very limited populations evaluated* Only consensus opinion of experts, case studies or standard of care	• Recommendation that procedure or treatment is useful/effective • Only expert opinion, case studies, or standard of care	• Recommendation in favor of treatment or procedure being useful/effective • Only diverging expert opinion, case studies, or standard of care	• Recommendation's usefulness/efficacy less well established • Only diverging expert opinion, case studies, or standard of care	• Recommendation that procedure or treatment is not useful/effective and may be harmful • Only expert opinion, case studies, or standard of care		

*Data available from clinical trials or registries about the usefulness/efficacy in different subpopulations, such as gender, age, history of diabetes, history of prior myocardial infarction, history of heart failure, and prior aspirin use. A recommendation with Level of Evidence B or C does not imply that the recommendation is weak. Many important clinical questions addressed in the guidelines do not lend themselves to clinical trials. Although randomized trials are unavailable, there may be a very clear clinical consensus that a particular test or therapy is useful or effective.

Methods Used to Analyze the Evidence

Review of Published Meta-Analyses

Systematic Review with Evidence Tables

Description of the Methods Used to Analyze the Evidence

Not stated

Methods Used to Formulate the Recommendations

Expert Consensus

Description of Methods Used to Formulate the Recommendations

A task force was assembled with the goal of addressing the more technical aspects of aortic and aortic valve surgery. Section authors drafted their recommendations, using prior published guidelines as a reference when available, and circulated to the entire writing committee as drafts. Revisions were made until consensus was reached on class, level of evidence, references, and language.

Rating Scheme for the Strength of the Recommendations

See the "Rating Scheme for the Strength of the Evidence" field, above.

Cost Analysis

The original guideline document contains detailed cost analyses (e.g., devices and cost of care) within the recommendations sections.

Method of Guideline Validation

External Peer Review

Internal Peer Review

Description of Method of Guideline Validation

The full document was submitted for approval by the Society of Thoracic Surgeons (STS) Workforce on Evidence Based Surgery before publication. The guidelines were posted on the STS website for an open comment period. The guidelines then were also submitted to the STS Council on Quality, Research, and Patient Safety Operating Board and the STS Executive Committee before submission for publication.

Evidence Supporting the Recommendations

References Supporting the Recommendations

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Type of Evidence Supporting the Recommendations

The type of supporting evidence is identified and graded for each recommendation (see the "Major Recommendations" field).

The guidelines rely primarily on nonrandomized trials, observational studies, registries, propensity analyses, and consensus statements of experts. When needed, the guidelines draw heavily from the previously published 2010 ACCF/AHA/AATS/ACR/ASA/SCA/SCAI/SIR/STS/SVM guideline for the diagnosis and management of patients with thoracic aortic disease.

Benefits/Harms of Implementing the Guideline Recommendations

Potential Benefits

- Appropriate evaluation and management of aortic valve and ascending aorta disease
- Better understanding of the pros and cons of current surgical treatment options

Potential Harms

- Risks of procedures include risk of systemic emboli necessitating anticoagulation of a thrombogenic heart valve replacement device with its attendant risks of hemorrhage, catastrophic prosthesis failure, prosthetic valve endocarditis, hemolysis from periprosthetic regurgitation, stroke, paraplegia, and death early after a procedure.
- Exercise testing should not be performed in symptomatic patients owing to a high risk of complications.

Refer to the "Cons" sections of the original guideline document for harms and/or disadvantages of specific interventions.

Contraindications

Contraindications

- Temporary contraindications to valve replacement include sepsis, severe debilitation, acute neurological event, coagulopathy, congestive heart failure, and ventilator dependence, etc.
- Anatomic factors such as true porcelain aorta, which would be a contraindication to conventional aortic valve replacement (AVR), are amenable to a transapical approach.
- Contraindications for the transapical procedure include calcification of the pericardium or left ventricular (LV) apex, patch repair of the apex secondary to an aneurysmectomy, LV apex thrombus, or severe respiratory insufficiency that would be exacerbated by a thoracotomy. Additionally, certain anatomic abnormalities that preclude accessing the LV apex, such as extreme rotation of the heart or previous pneumonectomy resulting in dislocation of the heart into either the right or left chest, rule out a transapical approach.
- Contraindications for the direct aortic procedure include atheroma or calcification of the ascending aorta that the surgeon believes precludes placement and safe closure of the aorta. Additionally, certain factors may preclude a direct aortic approach such as anatomic displacement of the aorta (pneumonectomy).

Qualifying Statements

Qualifying Statements

- The Society of Thoracic Surgeons Clinical Practice Guidelines are intended to assist physicians and other health care providers in clinical decision making by describing a range of generally acceptable approaches for the diagnosis, management, or prevention of specific diseases or conditions. These guidelines should not be considered inclusive of all proper methods of care or exclusive of other methods of care reasonably directed at obtaining the same results. Moreover, these guidelines are subject to change over time, without notice. The ultimate judgment regarding the care of a particular patient must be made by the physician in light of the individual circumstances presented by the patient.
- These guidelines have summarized the current knowledge in the treatment of aortic valve and aortic disease. Clearly there are many questions and these can only partially be answered from incomplete data sets. Undoubtedly, newer iterations will update these guidelines. The choice of the best procedure or valve for patients is dependent on many factors and no procedure or device is ideal. Ultimately it is up to the patient, the cardiologist, and surgeon to reach a decision on appropriate treatment.

Implementation of the Guideline

Description of Implementation Strategy

An implementation strategy was not provided.

Implementation Tools

Chart Documentation/Checklists/Forms

Clinical Algorithm

Quality Measures

Quick Reference Guides/Physician Guides

Resources

For information about availability, see the *Availability of Companion Documents* and *Patient Resources* fields below.

Institute of Medicine (IOM) National Healthcare Quality Report Categories

IOM Care Need

Getting Better

Living with Illness

IOM Domain

Effectiveness

Patient-centeredness

Identifying Information and Availability

Bibliographic Source(s)

Svensson LG, Adams DH, Bonow RO, Kouchoukos NT, Miller DC, O'Gara PT, Shahian DM, Schaff HV, Akins CW, Bavaria JE, Blackstone EH, David TE, Desai ND, Dewey TM, D'Agostino RS, Gleason TG, Harrington KB, Kodali S, Kapadia S, Leon MB, Lima B, Lytle BW, Mack MJ, Reardon M, Reece TB, Reiss GR, Roselli EE, Smith CR, Thourani VH, Tuzcu EM, Webb J, Williams MR. Aortic valve and ascending aorta guidelines for management and quality measures. Ann Thorac Surg. 2013 Jun;95(6 Suppl):S1-66. [453 references] PubMed

Adaptation

Not applicable: The guideline was not adapted from another source.

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Financial Disclosures/Conflicts of Interest

For authors' disclosure of industry relationships, see Appendix 2 in the original guideline document .

Guideline Status

This is the current release of the guideline.

Guideline Availability

Electronic copies: Available in Portable Document Format (PDF) from the Society of Thoracic Surgeons Web site .

Print copies: Available from The Society of Thoracic Surgeons, 633 N. Saint Clair St., Suite 2320, Chicago, IL, USA 60611-3658

Availability of Companion Documents

The following is available:

- Svensson LG, Adams DH, Bonow RO, Kouchoukos NT, Miller DC, O'Gara PT, Shahian DM, Schaff HV, Akins CW, Bavaria JE, Blackstone EH, David TE, Desai ND, Dewey TM, D'Agostino RS, Gleason TG, Harrington KB, Kodali S, Kapadia S, Leon MB, Lima B, Lytle BW, Mack MJ, Reardon M, Reece TB, Reiss GR, Roselli EE, Smith CR, Thourani VH, Tuzcu EM, Webb J, Williams MR. Aortic valve and ascending aorta guidelines for management and quality measures: executive summary. Ann Thorac Surg. 2013;95:1491-505. Available in Portable Document Format (PDF) from the Society of Thoracic Surgeons Web site .

In addition, quality measures are available throughout the original guideline document. A data collection form for valves and procedures for data collection are available in Appendix 1 in the original guideline document .

Patient Resources

None available

NGC Status

This NGC summary was completed by ECRI Institute on December 10, 2013. This summary was updated by ECRI Institute on March 6, 2014 following the U.S. Food and Drug Administration advisory on Over-the-Counter Topical Antiseptic Products.

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